The following five indicators (C-3.6-C3.10) should be selected as appropriate to a particular course for additional content and depth:

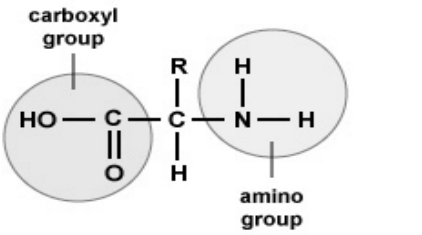
C-3.6 Identify the basic structure of common polymers (including proteins, nucleic acids, plastics, and starches). (additional content/depth)

Revised Taxonomy Level 1.1 B (Identify conceptual knowledge)

Students did not study this concept in physical science

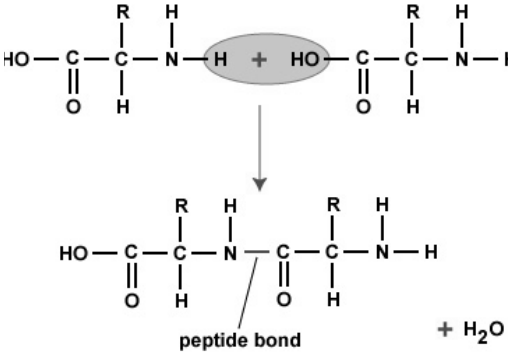
It is essential for students to

- Recognize the basic structure of a protein as that of a polymer composed of monomers of amino acids.
  - The basic structure of an amino acid is



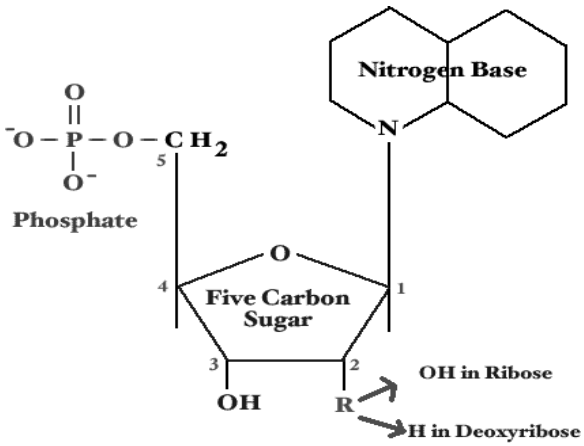
Amino Acid

  - Where "R" represents H, CH_3 or a more complex organic functional group
  - Understand that there are 20 amino acids commonly found in proteins, that differ with regard to the "R" group
  - Understand that peptide bonds are formed between the amino acids to form proteins



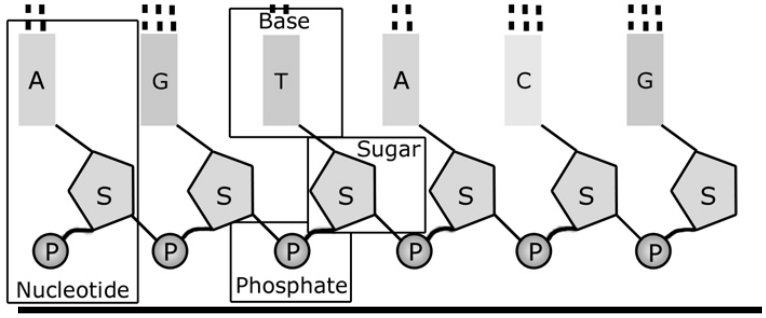
Protein

- Recognize the basic structure of a nucleic acid as that of a polymer composed of monomers of nucleotides.
  - The basic structure of a nucleotide is that of a



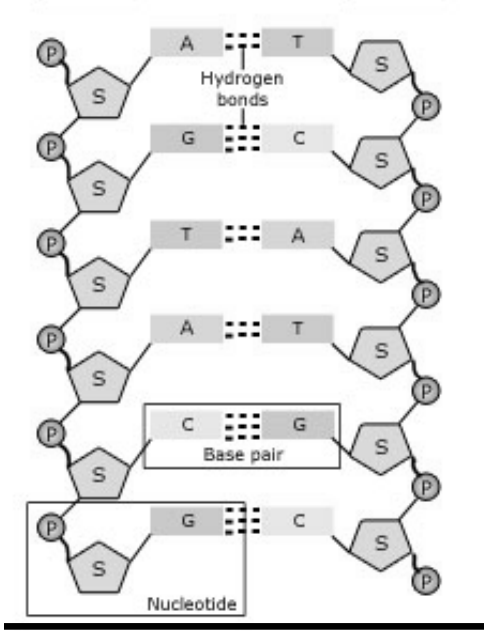
Nucleotide

- An organic functional group ("R") representing H, CH_3 or a more complex organic functional group
- Phosphate
- A five-carbon sugar
- A nitrogen base (the structure of the nitrogen base varies with different nucleic acids)
  - Uracil (U)
  - Cytosine (C)
  - Thymine (T)
  - Adenine (A)
  - Guanine (G)
- The nucleotides form the nucleic acid polymer by bonding between sugars and phosphates



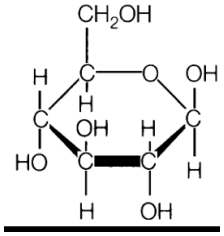
Single stranded DNA

- Duplication of the polymers result from bonding at the bases
  - T only bonds with A or U
  - G only bonds with

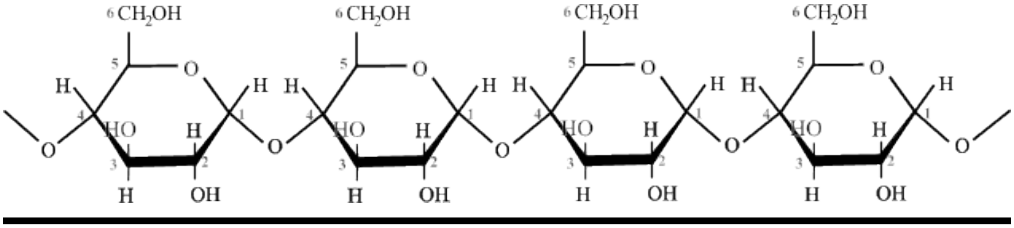


Double Stranded DNA

- Recognize the basic structure of carbohydrate as that of a polymer composed of monomers called monosaccharides (simple sugars).
  - Monosaccharides contain carbon hydrogen and oxygen in a ratio of 1:2:1 which gives an empirical formula of CH_2O
  - Starch is composed of monosaccarides of glucose



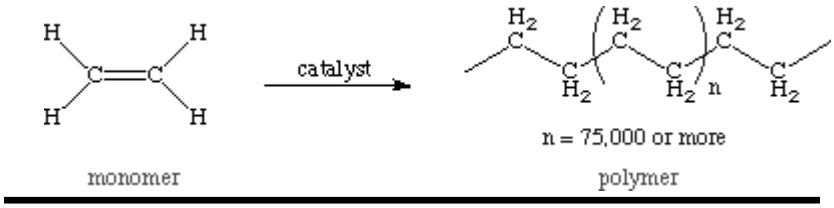
Glucose



Starch

- Understand that a plastic is a synthetic polymer (polymer prepared in the laboratory or industry) that is easily molded.
  - There are two types of plastic
    - Thermoplastics which soften or melt when heated
    - Thermosetting plastics which harden or set when heated and do not remelt

- Recognize the basic structure of a plastic as that of a polymer composed of monomers derived from petroleum
  - An example is polyethylene with monomers of ethylene



Ethylene **Polyethylene**

Assessment

As the verb for this indicator is recognize (identify), the major focus of assessment should be for students to "locate knowledge in long term memory that is consistent with presented material; in this case, for students to be able to identify the substances presented here as polymers, and to recall the general composition and the name of the monomers which compose them when presented with diagrams or descriptions of the substances. Conceptual knowledge requires that students understand the interrelationships among the basic elements within a larger structure that enable them to function together, in this case, that students know how the parts of each polymer come together to form the whole.